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MOTOROLA

MC33269

Advance Information

Low Dropout Positive Fixed and Adjustable Voltage Regulators

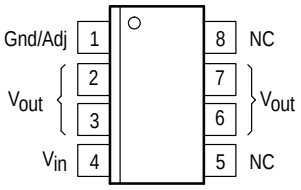
800 mA
LOW DROPOUT
THREE–TERMINAL
VOLTAGE REGULATORS

The MC33269 series are low dropout, medium current, fixed and adjustable, positive voltage regulators specifically designed for use in low input voltage applications. These devices offer the circuit designer an economical solution for precision voltage regulation, while keeping power losses to a minimum.

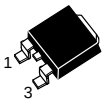
The regulator consists of a 1.0 V dropout composite PNP–NPN pass transistor, current limiting, and thermal shutdown.

- 3.3 V, 5.0 V, 12 V and Adjustable Versions
- Space Saving DPAK and SOP–8 Power Package
- 1.0 V Dropout
- Output Current in Excess of 800 mA
- Thermal Protection
- Short Circuit Protection
- Output Trimmed to 1.0% Tolerance
- No Minimum Load Requirement for Fixed Voltage Output Devices

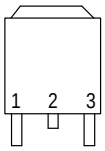
D SUFFIX
PLASTIC PACKAGE
CASE 751
(SOP–8)



(Top View)



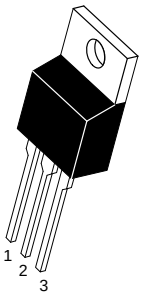
DT SUFFIX
PLASTIC PACKAGE
CASE 369A
(DPAK)



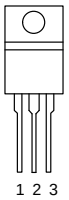
1. Gnd/Adj
2. V_{out}
3. V_{in}

(Top View)

Heatsink surface (shown as terminal 4 in case outline drawing) is connected to Pin 2.



T SUFFIX
PLASTIC PACKAGE
CASE 221A



Pin: 1. Gnd/Adj
2. V_{out}
3. V_{in}

(Top View)

Heatsink surface (shown as terminal 4 in case outline drawing) is connected to Pin 2.

ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC33269D	T_J = –40° to +125°C	SOP–8
MC33269DT		DPAK
MC33269T		Insertion Mount
MC33269D–3.3		SOP–8
MC33269DT–3.3		DPAK
MC33269T–3.3		Insertion Mount
MC33269D–5.0		SOP–8
MC33269DT–5.0		DPAK
MC33269T–5.0		Insertion Mount
MC33269D–12		SOP–8
MC33269DT–12		DPAK
MC33269T–12		Insertion Mount

DEVICE TYPE/NOMINAL OUTPUT VOLTAGE

MC33269D	Adj	MC33269D–5.0	5.0 V
MC33269DT	Adj	MC33269DT–5.0	5.0 V
MC33269T	Adj	MC33269T–5.0	5.0 V
MC33269D–3.3	3.3 V	MC33269D–12	12 V
MC33269DT–3.3	3.3 V	MC33269DT–12	12 V
MC33269T–3.3	3.3 V	MC33269T–12	12 V

This document contains information on a new product. Specifications and information herein are subject to change without notice.

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Power Supply Input Voltage	V_{in}	20	V
Power Dissipation			
Case 369A (DPAK)			
T_A = 25°C	P_D	Internally Limited	W
Thermal Resistance, Junction–to–Ambient	θ_{JA}	92	°C/W
Thermal Resistance, Junction–to–Case	θ_{JC}	6.0	°C/W
Case 751 (SOP–8)			
T_A = 25°C	P_D	Internally Limited	W
Thermal Resistance, Junction–to–Ambient	θ_{JA}	160	°C/W
Thermal Resistance, Junction–to–Case	θ_{JC}	25	°C/W
Case 221A			
T_A = 25°C	P_D	Internally Limited	W
Thermal Resistance, Junction–to–Ambient	θ_{JA}	65	°C/W
Thermal Resistance, Junction–to–Case	θ_{JC}	5.0	°C/W
Operating Junction Temperature Range	T_J	–40 to +150	°C
Storage Temperature	T_{stg}	–55 to +150	°C

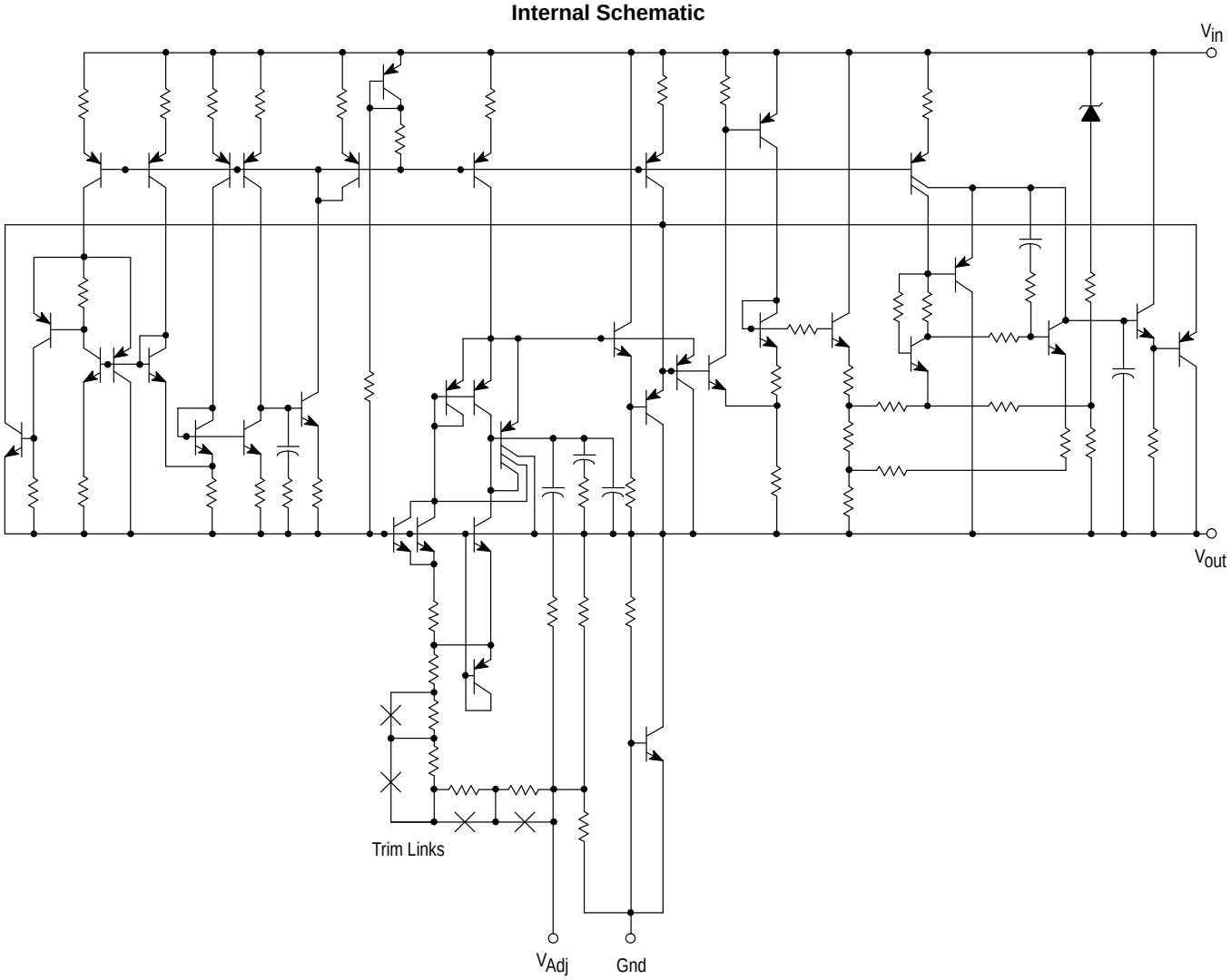
NOTE: ESD data available upon request.

ELECTRICAL CHARACTERISTICS (C_O = 10 µF, T_A = 25°C, for min/max values T_J = –40°C to +125°C, unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (I_{out} = 10 mA, T_J = 25°C)	V_O				V
3.3 Suffix (V_{CC} = 5.3 V)		3.27	3.3	3.33	
5.0 Suffix (V_{CC} = 7.0 V)		4.95	5.0	5.05	
12 Suffix (V_{CC} = 14 V)		11.88	12	12.12	
Output Voltage (Line, Load and Temperature) (Note 1)	V_O				V
(1.25 V ≤ V_{in} – V_{out} ≤ 15 V, I_{out} = 500 mA)					
(1.35 V ≤ V_{in} – V_{out} ≤ 10 V, I_{out} = 800 mA)					
3.3 Suffix		3.23	3.3	3.37	
5.0 Suffix		4.9	5.0	5.1	
12 Suffix		11.76	12	12.24	
Reference Voltage (I_{out} = 10 mA, V_{in} – V_{out} = 2.0 V, T_J = 25°C) Adjustable	V_{ref}	1.235	1.25	1.265	V
Reference Voltage (Line, Load and Temperature) (Note 1) (1.25 V ≤ V_{in} – V_{out} ≤ 15 V, I_{out} = 500 mA) (1.35 V ≤ V_{in} – V_{out} ≤ 10 V, I_{out} = 800 mA) Adjustable	V_{ref}	1.225	1.25	1.275	V
Line Regulation (I_{out} = 10 mA, V_{in} = [V_{out} + 1.5 V] to V_{in} = 20 V, T_J = 25°C)	Reg_{line}	–	–	0.3	%
Load Regulation (V_{in} = V_{out} + 3.0 V, I_{out} = 10 mA to 800 mA, T_J = 25°C)	Reg_{load}	–	–	0.5	%
Dropout Voltage	$V_{in} – V_{out}$				V
(I_{out} = 500 mA)		–	1.0	1.25	
(I_{out} = 800 mA)		–	1.1	1.35	
Ripple Rejection (10 Vpp, 120 Hz Sinewave; I_{out} = 500 mA)	RR	55	–	–	dB
Current Limit (V_{in} – V_{out} = 10 V)	I_{Limit}	800	–	–	mA
Quiescent Current (Fixed Output)	I_Q	–	5.5	8.0	mA
Minimum Required Load Current	I_{Load}				mA
Fixed Output		–	–	0	
Adjustable		8.0	–	–	
Adjustment Pin Current	I_{Adj}	–	–	120	µA

NOTE 1: The MC33269–12, V_{in} – V_{out} is limited to 8.0 V maximum, because of the 20 V maximum rating applied to V_{in}.

Internal Schematic



This device contains 38 active transistors.

Figure 1. SOP–8 Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length

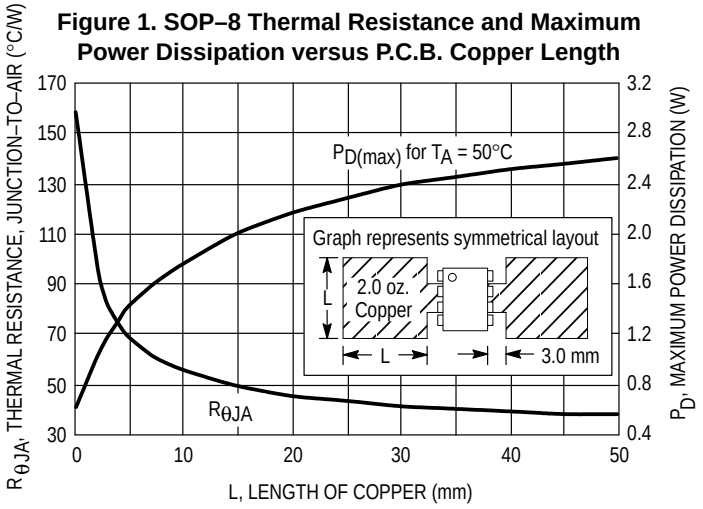


Figure 2. DPAK Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length

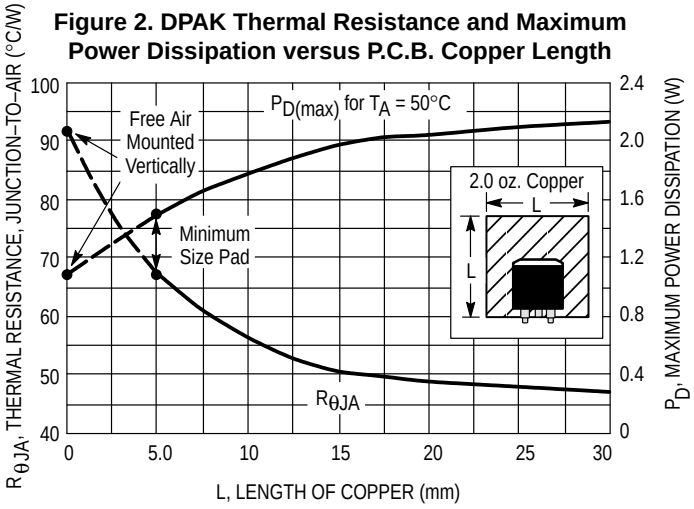


Figure 3. Dropout Voltage versus Output Load Current

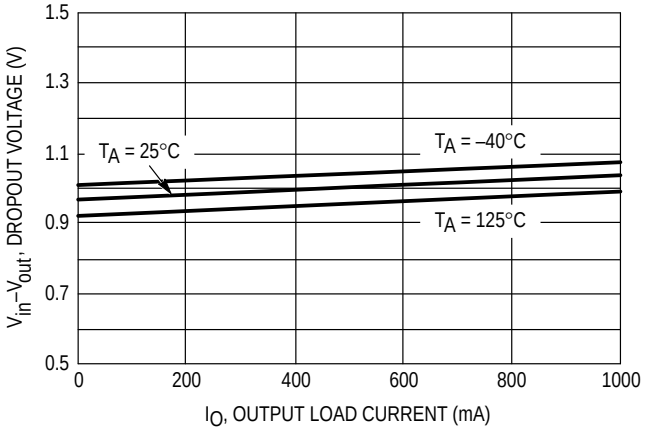


Figure 4. Transient Load Regulation

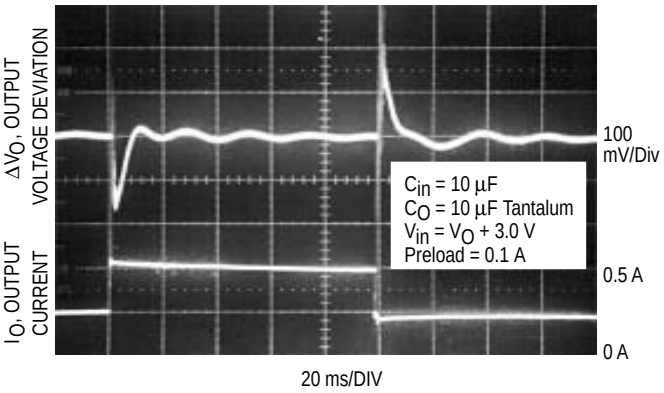


Figure 5. Dropout Voltage versus Temperature

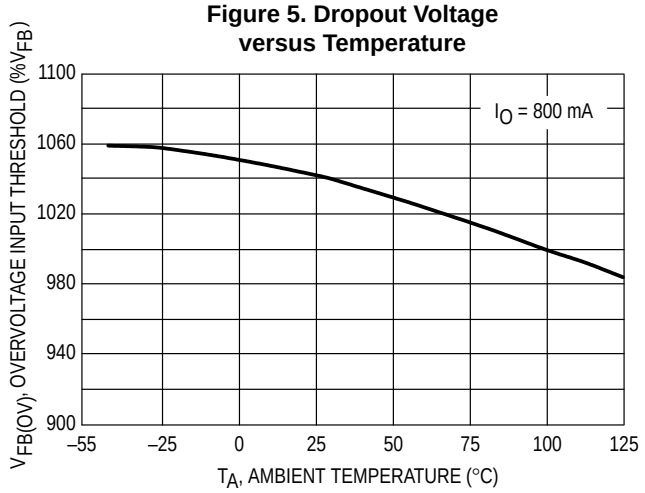


Figure 6. MC33269–XX Output DC Current versus Input–Output Differential Voltage

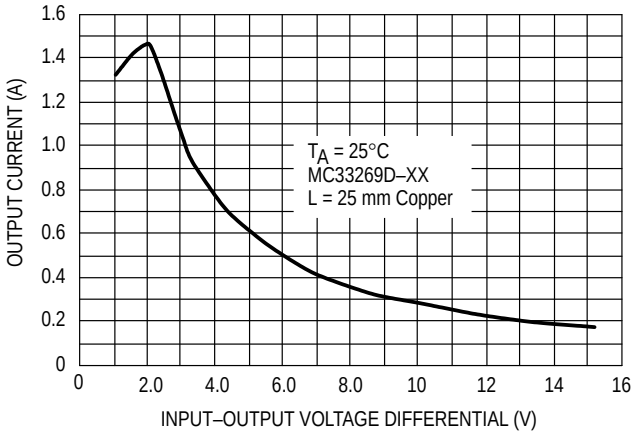


Figure 7. MC33269 Ripple Rejection versus Frequency

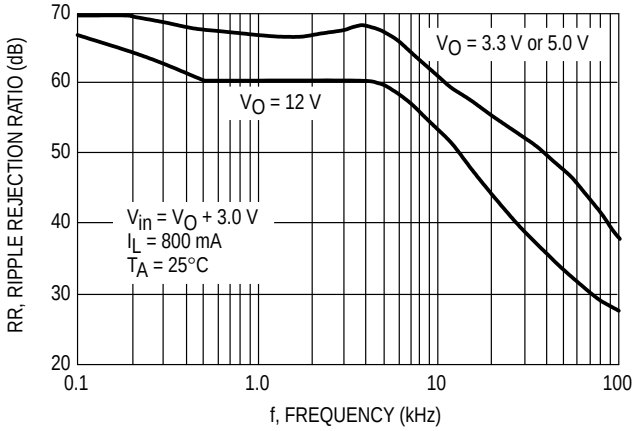
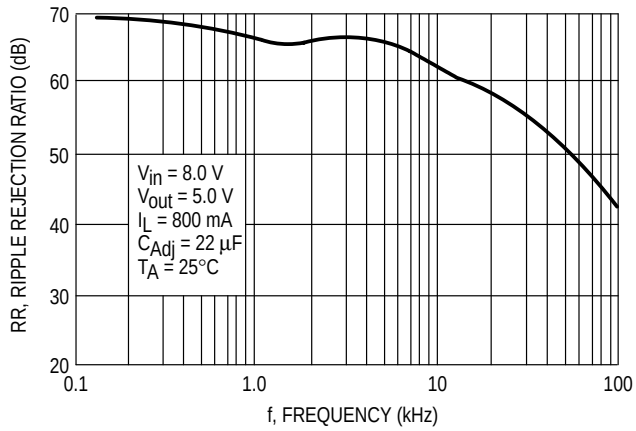


Figure 8. MC33269–ADJ Ripple Rejection versus Frequency



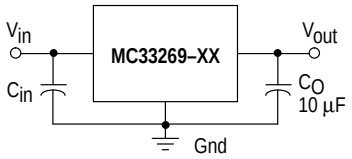
APPLICATIONS INFORMATION

Figures 9 through 13 are typical application circuits. The output current capability of the regulator is in excess of 800 mA, with a typical dropout voltage of less than 1.0 V. Internal protective features include current and thermal limiting.

The MC33269 is not internally compensated and thus requires an external output capacitor for stability. The capacitor should be at least 10 μF with an equivalent series resistance (ESR) of less than 10 Ω over the anticipated operating temperature range. With economical electrolytic capacitors, cold temperature operation can pose a problem. As temperature decreases, the capacitance also decreases and the ESR increases, which could cause the circuit to oscillate. Solid tantalum capacitors may be a better choice if small size is a requirement. Also capacitance and ESR of a solid tantalum capacitor is more stable over temperature. An input bypass capacitor is recommended to improve transient response or if the regulator is connected to the supply input filter with long wire lengths. This will reduce the circuit's sensitivity to the input line impedance at high frequencies. A 0.33 μF or larger tantalum, mylar, ceramic, or other capacitor having low internal impedance at high frequencies should be chosen. The bypass capacitor should be mounted with shortest possible lead or track length directly across the regulator's input terminals. **Applications should be tested over all operating conditions to insure stability.**

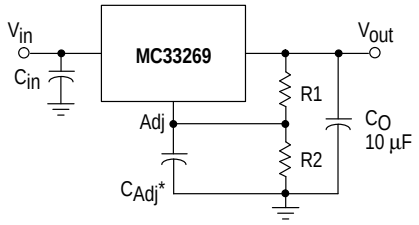
Internal thermal limiting circuitry is provided to protect the integrated circuit in the event that the maximum junction temperature is exceeded. When activated, typically at 170°C, the output is disabled. There is no hysteresis built into the thermal limiting circuit. As a result, if the device is overheating, the output will appear to be oscillating. This feature is provided to prevent catastrophic failures from accidental device overheating. **It is not intended to be used as a substitute for proper heatsinking.**

Figure 9. Typical Fixed Output Application



An input capacitor is not necessary for stability, however it will improve the overall performance.

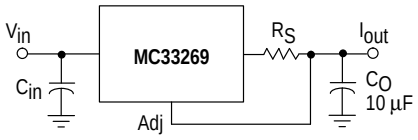
Figure 10. Typical Adjustable Output Application



$$V_{out} = 1.25 \left(1 + \frac{R2}{R1}\right) + I_{Adj} R2$$

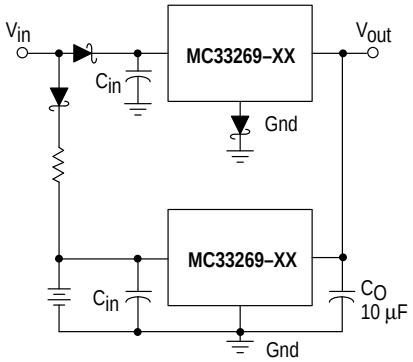
*C_{Adj} is optional, however it will improve the ripple rejection. The MC34269 develops a 1.25 V reference voltage between the output and the adjust terminal. Resistor R1, operates with constant current to flow through it and resistor R2. This current should be set such that the Adjust Pin current causes negligible drop across resistor R2. The total current with minimum load should be greater than 8.0 mA.

Figure 11. Current Regulator



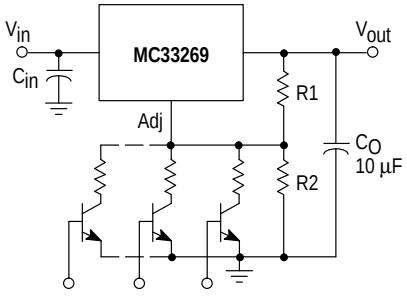
$$I_{out} = \frac{1.25}{R_S}$$

Figure 12. Battery Backed–Up Power Supply



The Schottky diode in series with the ground leg of the upper regulator shifts its output voltage higher by the forward voltage drop of the diode. This will cause the lower device to remain off until the input voltage is removed.

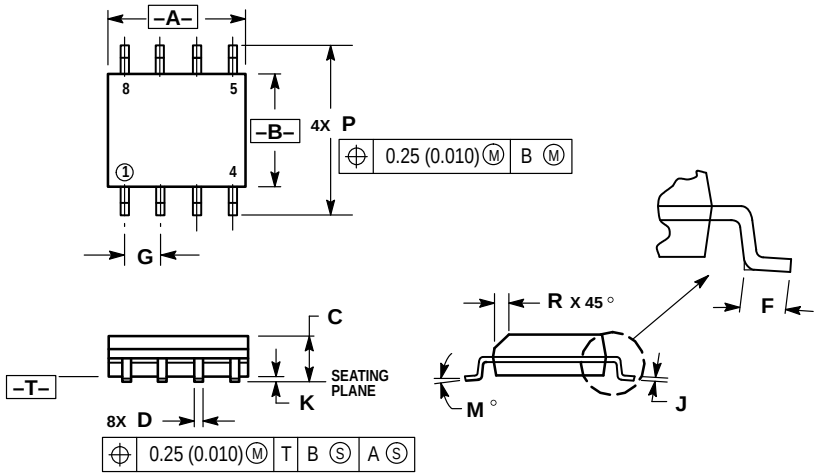
Figure 13. Digitally Controlled Voltage Regulator



R_2 sets the maximum output voltage. Each transistor reduces the output voltage when turned on.

OUTLINE DIMENSIONS

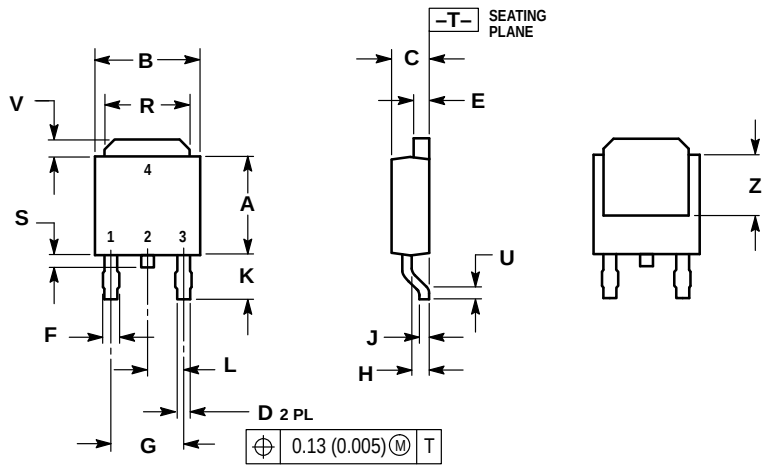
D SUFFIX
PLASTIC PACKAGE
CASE 751–05
(SOP–8)
ISSUE N



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.196
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.18	0.25	0.007	0.009
K	0.10	0.25	0.004	0.009
M	0 °	7 °	0 °	7 °
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

P SUFFIX
PLASTIC PACKAGE
CASE 369A–13
(DPAK)
ISSUE W

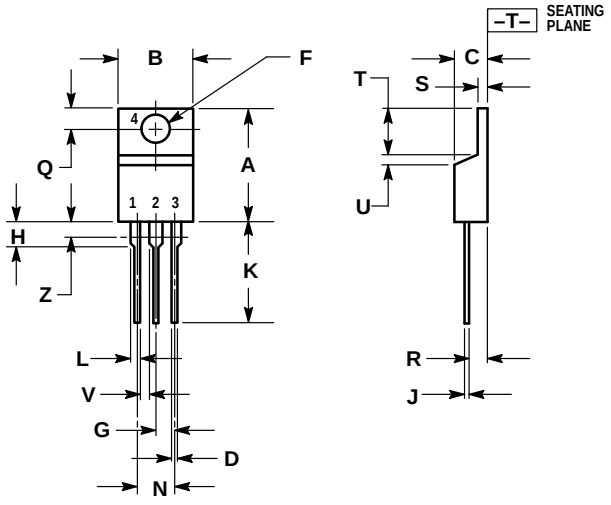


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.235	0.250	5.97	6.35
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.033	0.040	0.84	1.01
F	0.037	0.047	0.94	1.19
G	0.180 BSC		4.58 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.102	0.114	2.60	2.89
L	0.090 BSC		2.29 BSC	
R	0.175	0.215	4.45	5.46
S	0.020	0.050	0.51	1.27
U	0.020	—	0.51	—
V	0.030	0.050	0.77	1.27
Z	0.138	—	3.51	—

OUTLINE DIMENSIONS

T SUFFIX
PLASTIC PACKAGE
CASE 221A–06
ISSUE Y



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	—	1.15	—
Z	—	0.080	—	2.04

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